

ANNUAL REPORT FOR 2003



Bethel Church Mitigation Site

Yadkin County

Project No. 6.779004T

TIP No. R-2120WM



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North Carolina Department of Transportation
December 2003

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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the Bethel Church Mitigation Site. Site construction began in December 2000 and was completed in February 2001. Monitoring activities in 2003 represent the third year of monitoring for the site. The site must demonstrate both hydrologic and vegetation success for a minimum of five years or until the site is deemed successful.

The site is monitored with six groundwater gauges (five in the restoration areas, one in the existing wetland area), one rain gauge and four vegetation plots.

The daily rainfall data depicted on the monitoring gauge graphs was recorded from an onsite rain gauge. An offsite rain gauge, maintained by the NC State Climate Office in Yadkinville, contributed to the daily rainfall data and historical rainfall data used for the 30th –70th percentile analysis.

The 2003-year represents the third consecutive year for hydrology monitoring. All six groundwater gauges exceeded the success criteria of saturation within 12" of the soil surface for greater than 5% of the growing season. Four of these gauges met success for 100% of the growing season, during an above average rainfall year.

The 2003 vegetation monitoring of the site revealed an average density of 407 trees per acre, which is above the minimum success criteria of 320 trees per acre. The stream channel was visually inspected during the annual vegetation monitoring of the site. Localized slope problems on the north side of the site (noted in June 2003) are stabilizing with vegetation. The in-stream rock structure on the south side of the site is an old check dam that was partially removed; it does not appear to be compromising the integrity of the stream. The streambanks were stable with herbaceous vegetation cover throughout the majority of the monitored reach.

NCDOT will continue to monitor Bethel Church Mitigation Site for hydrology and vegetation.

1.0 INTRODUCTION

1.1 Project Description

The Bethel Church Mitigation Site is located on US 421, west of Yadkinville and adjacent to an unnamed tributary to South Deep Creek in Yadkin County (Figure 1). This site mitigates for wetland impacts associated with the improvements to US 421 New Location (R-2120AB).

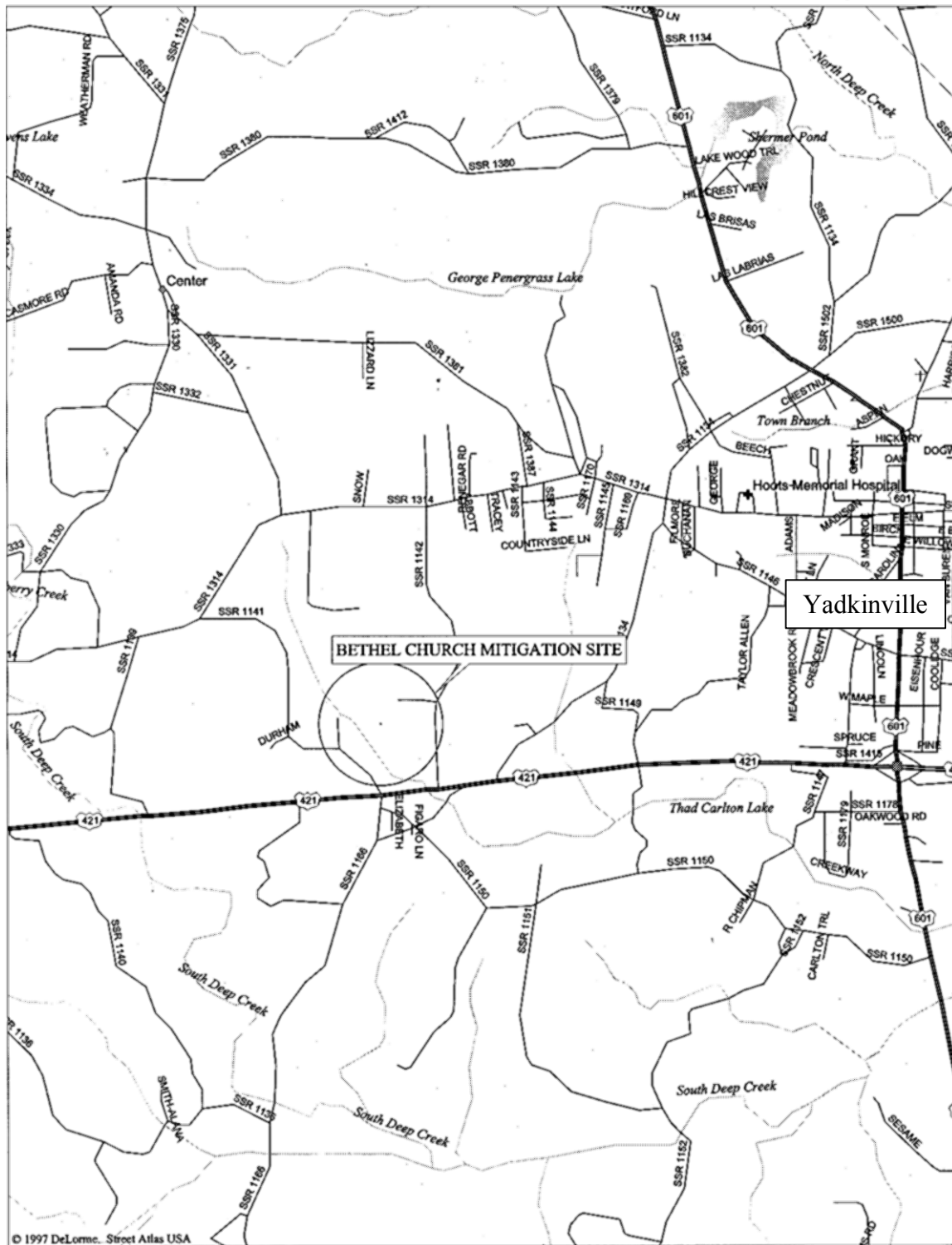
The Bethel Church Mitigation Site is divided into two parcels (North and South), totaling approximately 8.0 acres (ac) in size. The site consists of 3.03 acres of bottomland hardwood wetland restoration, 0.8 acres of wetland enhancement, 850 feet of stream restoration and 4.2 acres of upland buffer. Site construction began in December 2000 and was completed in February 2001. The site was initially planted in March of 2001. In January 2002, supplemental planting was performed in the enhancement area.

In addition to the original mitigation plan, the Department purchased Lots 1-20, which are adjacent parcels of land to the west of Fox Drive and extending (north) up to the Controlled Access along US 421. These parcels are completely wooded, consisting of upland forest and bottomland hardwood floodplain sections adjacent to the stream. By acquiring these parcels, the fill material associated with Fox Drive was completely removed to match the wetland mitigation site contours. The in-stream culvert was also removed during construction.

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five consecutive years. Success criteria for hydrology and vegetation are based on the approved mitigation plan dated August 1998. The following report details the results of hydrologic and vegetative monitoring activities that were performed during the 2003-growing season at the Bethel Church Mitigation Site.

Figure 1. Site Location Map



1.3 Project History

August 1998	Mitigation Plan
February 2001	Site Construction Completed
March 2001	Site Planted
March 2001	Monitoring Gauges Installed
March- October 2001	Hydrologic Monitoring (1 yr.)
July 2001	Vegetation Monitoring (1 yr.)
January 2002	Enhancement Area Supplemental Planting
April- October 2002	Hydrologic Monitoring (2 yr.)
August 2002	Vegetation Monitoring (2 yr.)
April-October 2003	Hydrologic Monitoring (3 yr.)
September 2003	Vegetation Monitoring (3 yr.)

1.4 Debit Ledger

Table 1. Bethel Church Debit Ledger

Bethel Church	Mitigation Plan			Ratio	TIP DEBIT
Habitat	Acres At Start	Acres Remaining	%		R-2120AA & AB
	7	0	0.0		7
TOTAL	7	0	0.0		

2.0 HYDROLOGY

2.1 Success Criteria

Per the mitigation plan dated August, 1998, surface and groundwater hydrology on the Bethel Church Mitigation Site shall be monitored for five years following the completion of all implementation activities, or until hydrologic success criteria are met. Hydrologic success for this site is defined as the presence of the water table within 12 inches of the soil surface for 5 -12 % of the growing season during a normal rainfall year.

The growing season in Yadkin County begins April 9 and ends October 28. These dates correspond to a 50% probability that temperatures will drop to 28°F or lower after April 9 and before October 28.¹ The growing season is 202 days; therefore, optimum hydrology requires 12.5% of this season, or at least 25 consecutive days. Local climate must also represent average/normal conditions for the area.

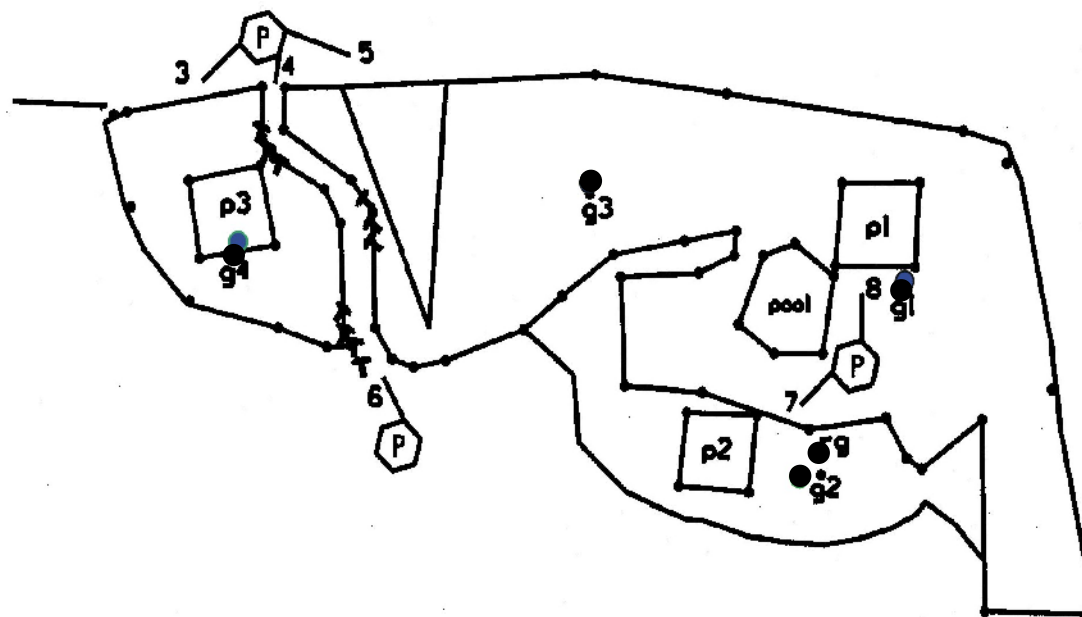
2.2 Hydrologic Description

In March 2001, six groundwater gauges were installed across the site (Figure 2). The automatic monitoring gauges record daily readings of groundwater depth. This represents the third growing season that the monitoring gauges have been in place since construction of the site.

The Bethel Church Site was designed to restore the natural flooding regime of the headwater stream. Hydrology for the site is naturally dominated by overbank flooding of the small, unnamed tributary of South Deep Creek. The hydrologic monitoring should show the reaction of the groundwater level to specific rainfall events and the extent of ponding that may be attributed to overbank flooding.

Figure 3 provides a graphical representation of the hydrologic results. Gauges highlighted in blue indicate wetland hydrology for more than 12.5% of the growing season. Gauges highlighted in green show hydrology between 8% and 12.5% of the growing season. Those gauges highlighted in red indicate wetland hydrology between 5% and 8%.

¹ Soil Conservation Service, Soil Survey of Yadkin County, North Carolina.



2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each gauge. This number was converted into a percentage of the 202-day growing season. The results are presented in Table 1.

Appendix A contains a plot of the groundwater depth for each monitoring gauge. The maximum number of consecutive days is noted on each graph. An onsite rain gauge was used to obtain rainfall data from the site. It has been compared with rainfall data obtained from the State Climate Office Local Weather Station in Yadkinville, which is approximately 2 miles from the mitigation site.

Table 2. 2003 Hydrologic Monitoring Results

Monitoring Gauge	<5%	5%-8%	8%-12.5%	>12.5%	Actual %	Success Dates
GW-1				X	48.3	April 9-July 15
GW-2				X	70.4	April 9-August 29
GW-3				X	100	April 9-October 28
GW-4				X	100	April 9-October 28
GW-5				X	100	April 9-October 28
GW-6				X	100	April 9-October 28

*The highlighted gauge is located in the existing wetland enhancement area.

*The 2003 growing season year experienced above average rainfall.

Specific Gauge Problems:

- Gauge (GW-1) stopped recording data (July 16-October 29). The gauge was replaced.

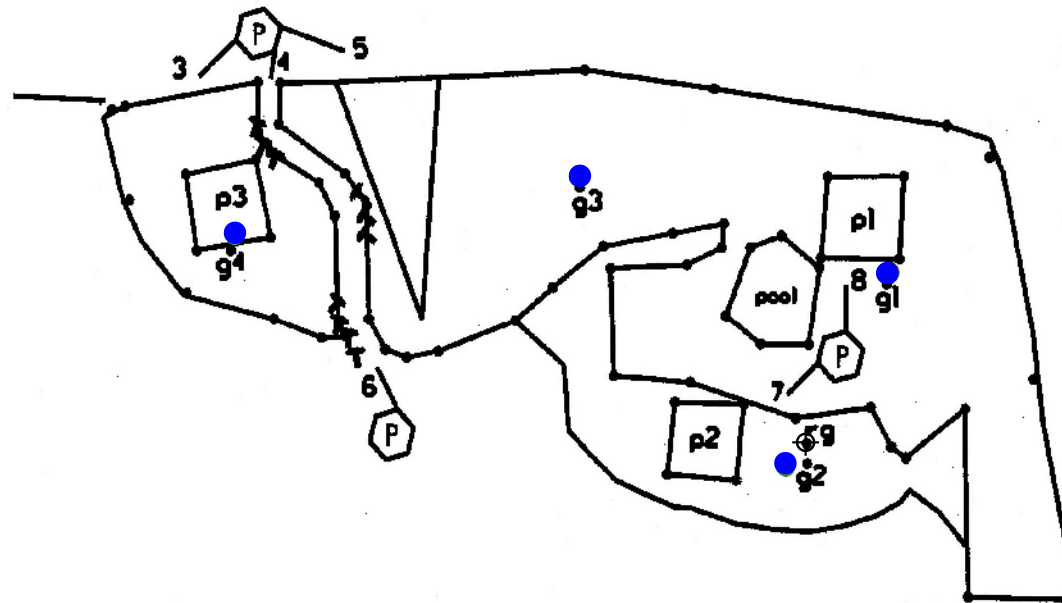
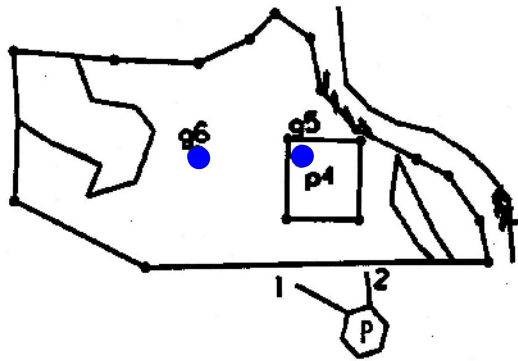


Figure 3. 2003 Hydrologic Monitoring Gauge Results

Hydrology Results

- < 5%
- 5 - 8%
- 8 - 12.5%
- > 12.5%

- ⊕ Rain Gauge
- Surface Gauge

N
Not to Scale



2.3.2 Climatic Data

Figure 4 is a comparison of monthly rainfall for the period of November 2002 through November 2003 to historical precipitation (collected between 1972 and 2003) for Yadkinville, North Carolina. This comparison gives an indication of how 2003 relates to historical data in terms of climate conditions. The NC State Climate Office provided all local rainfall information.

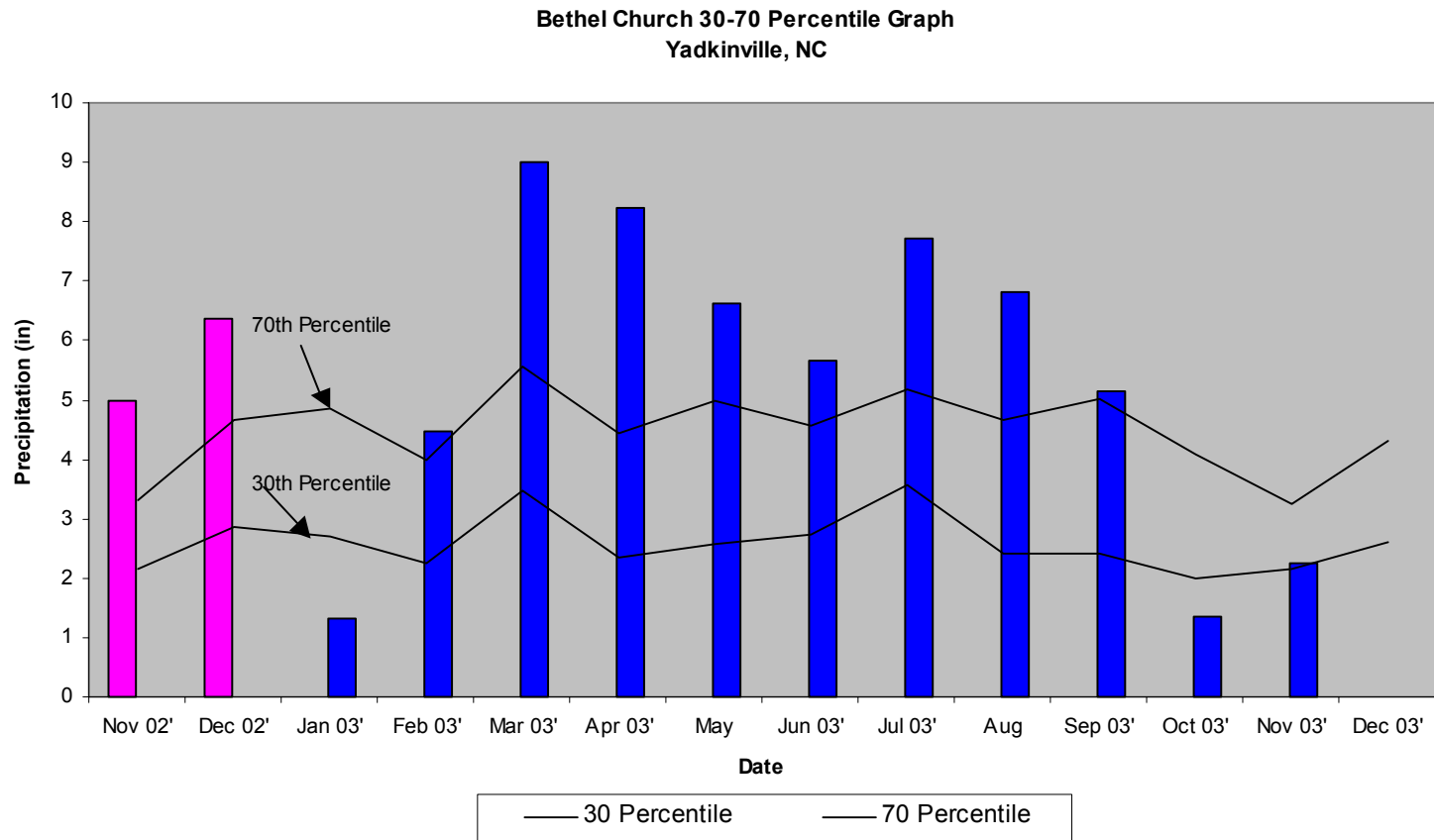
For the 2003-year, November (02'), December (02'), February, March, April, May, June, July, August, and September experienced above average rainfall. The months of January, October, and November recorded below average rainfall for the site. Overall, 2003 experienced an above average rainfall year.

2.4 Conclusions

The 2003-year represents the third consecutive year for hydrology monitoring. All six groundwater gauges exceeded the success criteria of saturation within 12" of the soil surface for greater than 5% of the growing season. Four of these gauges met success for 100% of the growing season, during an above average rainfall year.

NCDOT will continue to monitor the Bethel Church Mitigation Site for hydrology.

Figure 4: 30-70 Percentile Graph



3.0 VEGETATION: BETHEL CHURCH MITIGATION SITE (YEAR 3 MONITORING)

3.1 Success Criteria

Success criteria are defined as 320 trees per acre of the target species surviving at the end of three years and 260 trees per acre of the target species surviving at the end of five years.

3.2 Description of Species

The following species were planted in the Wetland Restoration Area:

Carya cordiformis, Bitternut Hickory

Fraxinus pennsylvanica, Green Ash

Platanus occidentalis, Sycamore

Quercus nigra, Water Oak

Quercus palustris, Pin Oak

Quercus phellos, Willow Oak

Quercus rubra, Northern Red Oak

3.3 Results of Vegetation Monitoring

Table 3. Vegetation Monitoring Statistics

Plot #	Bitternut Hickory	Green Ash	Sycamore	Water Oak	Pin Oak	Willow Oak	Northern Red Oak	Total (3 year)	Total (at planting)	Density (Trees/Acre)
1		5	10	4		5	1	25	36	472
2		13	6	1	1		6	27	40	459
3		13	1		1	10		25	51	333
4		15	1	1		7		24	45	363
AVERAGE DENSITY										407

Site Notes: Other species noted: foxtail, ragweed, red maple, *Juncus* sp., *Panicum* sp., *Sagittaria* sp., smartweed, cattail, woolgrass, pokeweed, silky dogwood, black willow, multi-flora rose, poison ivy, volunteer green ash, lespedeza, goldenrod, river birch, and alder. Plot 2 had heavy growth competition, which made it difficult to find trees. Northern Red Oak was noted growing in higher elevations on the site.

3.4 Conclusions

Red maples in the enhancement area (area around plot 2) were cut and treated with Oust in December 2001. Supplemental tree planting in the area around plots 1 and 2 was conducted in January 2002. The 2003 vegetation monitoring of the site revealed an average density of 407 trees per acre, which is above the minimum success criteria of 320 trees per acre.

The stream channel was visually inspected during the annual vegetation monitoring of the site. Localized slope problems on the north side of the site (noted in June 2003) are stabilizing with vegetation. The in-stream rock structure on the south side of the site is an old check dam that was partially removed; it does not appear to be compromising the integrity of the stream. The streambanks were stable with herbaceous vegetation cover throughout the majority of the monitored reach. Photos 9 through 16 show the conditions of the stream. No remedial actions are necessary.

NCDOT will continue vegetation monitoring at the Bethel Church Mitigation Site.

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

The Bethel Church Mitigation Site has met the success criteria prescribed in the mitigation plan during an above average rainfall year. All six groundwater gauges exceeded the success criteria of saturation within 12" of the soil surface for greater than 5% of the growing season. Four of these gauges met success for 100% of the growing season.

The 2003 vegetation monitoring of the site revealed an average density of 407 trees per acre, which is above the minimum success criteria of 320 trees per acre. The stream channel was visually inspected during the annual vegetation monitoring of the site. Localized slope problems on the north side of the site (noted in June 2003) are stabilizing with vegetation. The in-stream rock structure on the south side of the site is an old check dam that was partially removed; it does not appear to be compromising the integrity of the stream. The streambanks were stable with herbaceous vegetation cover throughout the majority of the monitored reach.

NCDOT will continue to monitor Bethel Church Mitigation Site for hydrology and vegetation.

APPENDIX A

GAUGE DATA GRAPHS

APPENDIX B

SITE PHOTOS

PHOTO LOCATIONS & MONITORING PLOTS

Bethel Church



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8



Photo 9 (Stream)



Photo 10 (Stream)



Photo 11 (Stream)



Photo 12 (Stream)



Photo 13 (Stream)



Photo 14 (Stream)



Photo 15 (Stream)



Photo 16 (Stream)

[illegible]

PROJECT REFERENCE NO.	SHEET NO.
R-2020 AB	REF-3
E / W SHEET NO.	
	HYDRAULICS ENGINEER

STEEL PIPE GATE
SEE SPECIAL DETAIL
SHEET WM-5

 Photo Locations
 Monitoring Plots